Patterns of Animal Utilization in the Holocene of the Philippines: A Comparison of Faunal Samples from Four Archaeological Sites

KAREN M. MUDAR

THE PHILIPPINE ARCHIPELAGO IS A SERIES OF TROPICAL OCEANIC ISLANDS located off the eastern edge of the Sunda Shelf. While dramatically lower sea levels of 145–160 m during the middle and late Pleistocene uncovered the shelf and joined the Malay Peninsula and islands of Sumatra, Java, and Borneo into one land mass (Heaney 1985), this had little effect on accessibility to the oceanic Philippine Islands. Although relatively narrow water gaps, 12–25 km in width, existed between the archipelago and the Sunda Shelf at several times during the middle and late Pleistocene, the only major island that was connected to the mainland was Palawan,[1] which formed part of Sundaland during the middle Pleistocene. Therefore nonarboreal mammalian fauna entering the archipelago either swam or were rafted to the oceanic islands.

This isolation, combined with the relatively small size of the islands, has had a significant effect on the mammalian fauna, affecting both species diversity and morphology. The water barrier acted as a filter, allowing migration of small mammals, particularly murid rodents, and discouraging migration of other taxa. Small insectivores, for example, have high metabolic requirements, which make it unlikely that they would survive a lengthy rafting event. Other research on island biogeography (Heaney 1984) has shown that small isolated islands, in general, support a fauna depauperate in carnivores and large herbivores. In contrast to the 11 species of ungulates and 29 species of carnivores on Sumatra, the Philippines supports only three species of ungulates and two species of carnivores (Heaney 1984).

Island size may have a direct impact on body size, especially of herbivores. Isolated herbivore populations surviving on islands may respond to environmental pressures specific to the island's ecology or, alternatively, respond to removal of pressures encountered in mainland environments by changing size (Foster 1964). Small herbivores tend to increase in size, while large herbivores often respond to range restrictions by decreasing in size. In the Philippines, conditions of isolation

Karen M. Mudar is a Case Officer in the Repatriation Office, Museum of Natural History, Smithsonian Institution, Washington, D.C.

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and small island size had a predictable effect on large herbivore fauna. The bearded pig (*Sus barbatus*) is significantly smaller than its counterpart in Borneo, a condition that probably developed after entry into the oceanic islands (Mudar 1986). The tamarao (*Bubalus mindorensis*), which is currently restricted to Mindoro, is probably the result of paedomorphic dwarfing of water buffalo, which entered the Philippines during the middle Pleistocene (C. Groves, personal communication 1996).

The water barriers and small sizes of the Philippine Islands have thus impacted the mammalian faunal composition by restricting entry of taxa and promoting a decrease in the size of the larger herbivores. The resulting fauna is generally impoverished and exhibits a high degree of endemism when compared to similar islands on the Sunda Shelf (Heaney 1985). This has had a significant effect on the extractive strategies of human populations exploiting terrestrial resources in the Philippines.

Compared to other regions of Southeast Asia, pigs and deer, which are the largest wild animals widely available for exploitation in the Philippines, are relatively small. Pigs weigh up to 200 kg, and deer up to 260 kg. In contrast, water buffalos and large bovids on the Southeast Asian mainland may weigh up to 1200 kg. Furthermore, there is no indication that indigenous domestication of Philippine mammalian taxa took place. As a result, large amounts of meat were not consistently available; the most reliable sources of animal protein may have been marine and freshwater fish.

The introduction of large domestic animals into the Philippines, therefore, may have altered the subsistence of both foraging and agricultural groups. Introduced domestic animals include the pig, water buffalo, horse, cat, dog, and goat. The domestic pig, and possibly the chicken, provided predictable access to small to moderate amounts of meat. The water buffalo provided several hundred kilograms of meat, a sizable increase over the nearest-sized Philippine wild mammals: pigs and deer.

The purpose of this paper is to examine the ways in which these introduced species were integrated into Philippine prehistoric economies. Using faunal samples from four archaeological sites, ranging in date from 8500 B.C. to the seventeenth century A.D., the time of introduction and the role of various species in local economies is examined. Two sites, Sohoton I Cave and Pintu/Busibus Rock Shelter, are thought to have been used by hunter-gatherers. The Tanjay and Cebu City sites are open-air sites once inhabited by chiefdom-level agriculturalists engaged in overseas trade. Cebu City was also the site of a Spanish colony. The faunal samples from these sites illustrate the ways that animal resources were integrated into economies of varying scale and complexity.

In the first section of this paper, summary information about economically important animals in prehistoric and early historic Philippine cultures is presented. Both wild and domestic taxa are discussed. These brief histories serve to outline the limitations of our knowledge about conditions of introduction and assimilation of domestic animals into the local economies.

The second section contains results of faunal analyses from the four archaeological sites. Background information for each site is summarized, and the faunal composition of each sample is discussed. Intrasite comparisons of the assemblages explore differences in the assemblages between time periods and between differ-

ent locales within the sites, differences which may be tied to changing ecological conditions or contrasting social contexts.

The third section attempts to place these samples in a broader context. This provides an opportunity to compare the relative importance of various species in the economies of foraging and agricultural groups at different time periods in Philippines prehistory and early history. The impact that the introduction of new species had on the economies of Philippine prehistoric societies is considered, and I suggest that despite the relatively recent introduction of a number of mammalian species, faunal resources in the Philippines have remained relatively stable for the last several millennia.

COMMON WILD AND DOMESTIC ANIMALS IN EARLY PHILIPPINE ECONOMIES

The islands of the Philippine archipelago extend from 19° to 5° North latitude and 120° to 127° East longitude. The climate is generally tropical; the average temperature near sea level is 27.0° C (Flores and Balagot 1969 : 176). The greatest annual range in temperature, which occurs in northern Luzon, is 3.6° C (Flores and Balagot 1969 : 178), and this range decreases to 1.4° C in southern Mindanao.

Regional climatic differences reflect variations in rainfall more than temperature. Rainfall in the Philippines is influenced by air streams, tropical cyclones, the intertropical convergence zone, and topography (Flores and Balagot 1969 : 180). In general, rainfall decreases from east to west and from south to north. The driest area of the Philippines is the northwest corner of Luzon. The annual average rainfall for the archipelago is 253.3 cm (Flores and Balagot 1969 : 181).

Although local climate, flora, and topographic variation have influenced the distribution of fauna in the Philippines (Heaney et al. 1989), an important element in the present distribution of species is the middle Pleistocene configuration of the islands. A lower sea level of 120 m resulted in the formation of two "super-islands." These consist of Mindanao-Leyte-Samar-Bohol and Panay-Negros-Cebu. Luzon and Mindoro remained isolated from these super-islands, although both increased in land mass. The biogeography of Luzon is similar to that of Mindanao; they were separated from other islands by a water gap of less than 30 km. Mindoro is similar to Panay-Negros-Bohol. The configuration of these middle Pleistocene land masses was such that island populations even now retain unique characteristics derived from variability in ancestral populations, as explained below.

Ecological and ethnohistorical information about the most commonly utilized animal species is presented in the following section. Much of the ethnohistorical information about the sixteenth-century Philippines comes from Spanish chronicles. In these accounts, however, animals are incidental details to the main themes of encounter. They relay information about animal use as trade items, high-status food items, ritual use, and distribution across the landscape. These chronicles add depth and texture to the interpretations provided by the zooarchaeological analysis of the assemblages.

Fish

Fish resources in the Philippines can be found in three major habitats: fresh water, marine inshore waters, and marine offshore waters. Fish from lakes and rivers

include both species found only in fresh water and species that spend part of their life cycle in salt water. True freshwater fishes include two families of catfish, a climbing perch, and a family of carp (Herre 1924 : 250–251). Saltwater species that can also be found in freshwater environments include several species of sharks and rays, snappers (Lutjanidae), mullets (Mugifidae), and carangids (Carangidae). These fish may be caught with hook and line, traps, or nets. The large fish may be speared.

The marine inshore environments of most importance here are coral reefs, which support a wide variety of economic resources. These include a number of fish species, such as parrotfish (Scaridae) and wrasses (Labridae), which forage on corals and algae. Most may be caught by hook and line, netting, or spearing. Parrotfish, however, are rarely taken by hook and line and must be caught by another method (Grant 1972). These species have mouth parts that preserve well in archaeological contexts. As a result, they may be overrepresented in faunal assemblages.

Marine offshore species include yellowfin tuna (*Neothussus macropterus*), ocean bonito (*Katsuwonus pelamis*), mackerel (*Auxis thazard*), runner (*Elagatis bipinnulatus*), and carangids (*Caranx* sp.) (Domantay 1940 : 82). Domantay (1940 : 83) noted that these species can be caught using fairly primitive fishing gear, a paddled or sailed dugout usually equipped with two outriggers, a spear, and hooks and lines. He also noted that these same fish may be caught in fish corrals, especially those constructed in water at least 4 m deep.

Fish were an important economic and ritual resource in prehispanic Philippine societies. Both marine and freshwater species were exploited. Pigafetta (in Jocano 1975 : 50) recorded that members of his party dined on fish at a feast sponsored by the chief of Butuan. He also noted that fish were sacrificed in a ritual involving the slaughtering of a consecrated pig. Loarca observed Tagalogs sacrificing fish to *anitos* (spirits) in the vicinity of Manila (in Jocano 1975 : 109).

In some lowland societies fishing and the barter of fish was under chiefly control. Placencia observed that "the chiefs in some villages had fisheries with established limits, and sections of the rivers for markets. At these no one could fish, or trade in the markets, without paying for the privilege, unless he belonged to the chiefs' barangay or village" (in Jocano 1975 : 109). Fish skins may also have been a source of protective gear in the prehistoric Philippines. The Boxer's Codex mentions that helmets were made from fish skins (in Jocano 1975 : 226).

Chickens

The taxonomic status and the ultimate source of *Gallus* populations in the Philippine archipelago are unclear. Osteological changes in early domestic breeds are minimal; faunal analysts often rely on cultural alterations, such as removal of the tibio-metatarsal spur from males, to indicate captive breeding (West 1982). Noncaptive populations of chickens can be found in the Philippines, and these may be either feral or wild populations. While the domestic chicken undoubtably originated in Southeast Asia, where wild relatives are found, it is not known when they appeared in the Philippines and under what conditions. It is possible that the Philippines constitutes a center of chicken domestication.

Chickens (*Gallus gallus*) were widely distributed throughout the Philippines and

commonly exploited. They were used in sacrifices (Chirino in Jocano 1975 : 145), in prestations (Pigafetta in Jocano 1975 : 58), in ritual feasting (Placencia in Jocano 1975 : 119), and in sport (Pigafetta in Jocano 1975 : 80).

Cats

Domestic cats, *Felis domesticus*, were present in the Philippines by the time of Spanish contact. There are no wild felids in the Philippines, and the time and means of introduction of domestic varieties are largely unknown. The putative origin of the domestic cat is the Mediterranean region; mummified cats dating to 1500 B.C. have been found in Egyptian Old Kingdom tombs (Clutton-Brock 1981). It is possible that cats arrived in the Philippines as part of the expansion of Greek and Roman trade with India and, ultimately, with Southeast Asian after A.D. 1000. The benefits of cats have long been appreciated by ship owners and captains; ocean voyaging has been a primary means of disseminating domestic cats throughout the world (Todd 1977).

Pigafetta mentions, on at least two occasions, that he saw both dogs and cats in the Visayas (Jocano 1975 : 54, 72). They are not listed as items of trade, nor as objects of sacrifice or feasting. In Philippine societies, as in other parts of the world, cats may have been peripheral to the subsistence and social economy.

Dogs

The dog, *Canis familiaris*, was the first animal to be domesticated, and the distribution of this taxa in the prehistoric world coincides with that of humans, being found on all continents, including the New World and Australia. It is likely that dogs accompanied the earliest colonists to the Philippine archipelago. Like cats, dogs do not figure directly in the Spanish accounts of complex prehistoric Philippine cultures. Pigafetta mentions their presence in the Visayas (Jocano 1975 : 54, 72), but they are not listed as articles of trade or items of consumption. Although dogs are consumed in traditional contemporary Filipino societies, there is no Hispanic ethnohistorical record of dogs being eaten or sacrificed in ritual ceremonies.

Wild Pigs

Two species of pig occur in the Philippines: the wild bearded pig, *Sus barbatus*, and the domestic pig, *Sus scrofa*. The bearded pig is found on all major islands in the archipelago and is most closely related to the bearded pig on Borneo. Three subspecies occur in the Philippines: *Sus barbatus ahoenobarbus* on Palawan, *Sus barbatus cebifrons* on Cebu and Negros, and *Sus barbatus philippensis* on the remainder of the islands (Mudar 1986). Bearded pigs most likely migrated into the Philippines during the middle Pleistocene, swimming across the water gap between Palawan and Mindoro or between Borneo and southern Mindanao. Once established, bearded pigs underwent the size reduction that often accompanies large herbivores isolated on islands (Foster 1964). Despite their reduction in size, bearded pigs of the Philippines still share canine tooth dimensions with other populations, which feature distinguishes the taxon from the domestic species, *Sus scrofa* (Groves 1981). Both species are sexually dimorphic with respect to the

lower canine; the male canine is much larger and of a different shape. The shape of the lower canine in *S. barbatus* and *S. scrofa* males is distinctive and can be distinguished by measuring the inferior and posterior surfaces near the base of the tooth. The width of the inferior surface as a percentage of the posterior surface falls into nearly exclusive ranges for the two species (*S. scrofa* I/P = 61.5–109.1; *S. barbatus* I/P = 105.6–177.8) (Groves 1981 1 : 11). Thus, when present in a sample, the lower canines of male pigs can be used to identify the species.

Domestic Pigs

The domestic pig, *Sus scrofa*, has a long history in Southeast Asia. Domesticated populations are first known from the Near East (Flannery 1969), but may have been independently domesticated in southern China (Yan 1989). Linguistic evidence suggests that proto-Austronesian vocabulary contained separate words for domestic pig, **beRek*, and wild pig, **babuy* (Blust 1976 : 26). This implies that pigs were among the domestic animals brought by Austronesians to the Philippines more than 3000 years ago (Bellwood 1980). If so, domestic pigs have a long history in the Philippines.

The pig was an important element in the social and subsistence economy of Philippine chiefly societies. Pigs were used in rituals (Placencia in Jocano 1975 : 119; Churino in Jocano 1975 : 145; Colin in Jocano 1975 : 170), and they were frequently served at feasts (Boxer's Codex in Jocano 1975 : 206; Pigafetta in Jocano 1975 : 49). Magellan was presented with a gift of swine both by a chief of Butuan and a chief of Cebu (Pigafetta in Jocano 1975 : 49, 58). Pigs were listed as items offered in trade for European goods (Pigafetta in Jocano 1975 : 60). I suggest below that these pigs were derived from domestic populations.

Pigs are an important resource in recent traditional Filipino societies as well (Mudar 1982). Lowland Visayan farming households frequently raise pigs as a cash crop. They have a high reproductive rate and a rapid weight gain as piglets (a pound of flesh for every three to five pounds of feed [Harris 1985 : 67]). They are omnivorous in their diet and can exist on a variety of fruits, vegetables, and grains, only competing with humans for food. When full-grown, pigs can be driven to market, obviating the need to be carried. They can also survive in urban contexts. Although Nishimura (1992, and see below) argues that full-scale agriculture is unlikely to have been practiced within the immediate vicinity of the city of Cebu, Pigafetta observed pigs kept below the houses in the settlement (in Jocano 1975 : 60).

Deer

Two species of deer are recognized in the oceanic Philippine islands: *Cervus alfredi* is found in the western Visayas and *Cervus mariannus* is found in the eastern islands stretching from Luzon to Mindanao (Grubb and Groves 1983). Osteologically, the two species may be distinguished on the basis of differences in the shape of the nasal-frontal sutures of the skull (Grubb and Groves 1983). They are cruciform in shape in *Cervus alfredi*. In *Cervus mariannus*, the suture is not cruciform and is more blunt. *Cervus mariannus* also has distinctive allometric skull proportions: the skull is relatively narrow in relation to its length.

The distribution of these species reflects the separation of the two biogeographic subregions: Panay-Negros-Cebu and Mindanao-Leyte-Luzon. Grubb and Groves (1983) suggest that cervids entered the Philippines from Sundaland through the Sulu archipelago during the Pleistocene period at two separate times, accounting for the separate distributions of these two species. There is no evidence to suggest that deer were intentionally introduced by humans into the Philippines.

In contrast to other fauna, deer are rarely mentioned in Spanish accounts from the European contact period in the Philippines. Colin (in Jocano 1975 : 163) notes that the Visayans ate venison at banquets, and de Morga mentions that seventeenth-century trade with the Japanese included deerskins as items involved in exchange (in Scott 1984 : 78). In general, however, these taxa are not mentioned in accounts either of ritual sacrifice or traded items. This suggests that deer was not an important resource during this time period among lowland societies in the Philippines. Unlike wild pigs, which are drawn to agricultural fields, deer tend to withdraw from human contact (Mudar 1982), so that relatively high densities of human populations in coastal areas may have resulted in decreased reliable availability of this animal resource. Therefore, we expect the relative number of deer in faunal assemblages to be higher in undisturbed environments. Lowered availability may account for the small emphasis on deer as an element in sacrifice, ritual exchange, or feasting according to ethnohistorical accounts of relatively dense lowland populations.

Goats

The domestic goat, *Capra hircus*, undoubtably originated in the Near East in settlements on the margins of the Tigris-Euphrates plain (Flannery 1969). From this locus, the species radiated north and northwest into Europe and Asia and east into the Indian subcontinent. Goats were probably first introduced into the southern Philippines as part of the cargo of Islamic or earlier traders (Scott 1984) before the fifteenth century A.D. By Spanish contact, goat populations were established in domestic contexts throughout the Philippines.

The goat is the most versatile of ruminants in its feeding habits (Clutton-Brock 1981 : 57), being able to subsist on rough herbage and shrubs. This characteristic, along with its small size, probably accounts for the goat's adaptability to a tropical environment. The European colonists probably also encouraged the proliferation of a stock animal familiar to them from their native Spain, by maintaining their own herds and creating a market for milk and meat products.

Pigafetta noted that goats were present in the Visayas (in Jocano 1975 : 54), Mindanao (in Jocano 1975 : 78), and Palawan (in Jocano 1975 : 79). Goats were presented to Magellan by the "Prince of Zebu [Cebu]" (Pigafetta in Jocano 1975 : 58). The chief of Mactan, near Cebu, also sent Magellan a gift of two goats (Pigafetta in Jocano 1975 : 61). They were used as articles of trade (Pigafetta in Jocano 1975 : 60) and were items of ritual feasting among the Tagalogs (Placencia in Jocano 1975 : 119). The author of the Boxer Codex stated that Moros in the southern Philippines consumed goat, but also stated that Visayans did not eat goat meat or milk products (in Jocano 1975 : 197). Goats were common in Mindanao and in areas in contact with Muslims; they appear to have been raised

largely for trade (Scott 1990 : 302). By Spanish contact, goats figured in ritual and feasting in Philippine chiefly societies. They were also used as trade and food items, functions which probably increased with Spanish settlement.

Water Buffalo

Currently, there are two species of water buffalo found in the Philippines: the wild dwarf water buffalo or tamarao, *Bubalus mindorensis*, and the domestic water buffalo, *Bubalus bubalis*. The tamarao was found, historically, on the islands of Mindoro and Panay (although extinct on Panay today), and early ancestors probably migrated from the Sunda Shelf through Borneo and Palawan during the Pleistocene. The dwarf buffalo in the Philippines is significantly smaller than the domestic water buffalo, standing less than 1.3 m (4 ft) high at the shoulder (Sumulong 1931). There is no record of this species in the Spanish chronicles of contact, and to date, it has not been identified at archaeological sites on Mindoro or Panay (Coutts 1983).

The distribution of the wild ancestors of the domestic water buffalo extends from southern China to the western Indian subcontinent. Two main breeds are currently recognized: a river breed and a swamp breed. Morphological differences between the two breeds may be the result of domestication of populations at either end of a clinal distribution of the wild taxa. The river breed is characterized by tightly curled horns that sweep posteriorly from the skull. It is currently the most common breed in South Asia (Cockrill 1974). The swamp breed is identified by broad horns that project laterally from the skull. The domestic swamp breed is presently the most common breed in mainland and island Southeast Asia.

The origins of the domestic water buffalo have not been completely elucidated. Water buffalo horn cores have been recovered from fourth millennium B.C. deposits at Mehrgarh, Pakistan, and from Harappan contexts at Balakot, Pakistan (Meadow 1977). The morphology indicates that these are "swamp breed" individuals; whether these are wild or domestic is unknown. Although it has been proposed that the water buffalo was also domesticated in Southeast Asia (Clutton-Brock 1981; Cockrill 1974; Higham and Leach 1971), there is little osteological evidence to support this. Higham et al. (1981) argue that the third phalanges from third century B.C. Ban Chiang, Thailand, are from animals used for draft purposes. These were presumably domesticated animals.

The timing and means of introduction of the water buffalo into the Philippines are difficult to determine. The present populations were reintroduced into the islands after herd decimation during World War II and cannot be used as indicators of the characteristics of earlier breeds. Two skulls in the National Museum of Natural History (NMNH 131602, 112986) collected at the beginning of the twentieth century, however, exhibit the sweeping horns of the swamp breed. Photographs of water buffalo taken prior to World War II (Bureau of Insular Affairs 1903; Gale de Villa et al. 1988; Jenks 1905) also show swamp breed types. Lacking more complete data, I suggest that the dominant breed of domestic water buffalo in the prehispanic Philippines was the swamp breed.

The source of the prehispanic herds of swamp buffalo is not known. The Tagalog word for water buffalo, *carabao*, is found in the Indonesian language as well, which might suggest a donor-recipient relationship, although the direction is

unspecified. On the Southeast Asian mainland, water buffalo may have been domesticated primarily as a source of traction in the cultivation of wet rice (Higham 1989). It is possible that water buffalos were brought to the Philippines for the same purpose and, thus, were introduced at the same time that intensive wet rice agriculture was adopted.

Water buffalo populations were well established by the time of Spanish contact. They were used in sacrifices (Loarca in Jocano 1975 : 101) and were slaughtered for public feasting (Colin in Jocano 1975 : 163). Buffalo skins were even used for the manufacture of protective "armor" (Boxer's Codex in Jocano 1975 : 226). Ethnographic and ethnohistorical accounts indicate that public destruction and consumption of water buffalo herds figured prominently in determination of social rank among chiefly societies (Junker et al. 1994). Water buffalo are not mentioned as items of trade in Spanish accounts of contact. This suggests that water buffalo were considered too valuable to be traded. Scott (1990 : 302) also notes that water buffalo did not circulate as items of trade as did other animals. The water buffalo is not listed as a resource in colonial reports.

The ethnohistorical record also implies that feral populations may have been established in the Philippines by the time of Spanish contact. Loarca states that there are "a great many wild buffalos which, if caught while young, can be easily trained" (in Jocano 1975 : 101). The author of the Boxer Codex notes that "buffalos are found in some parts of these isles, very large and fierce" (in Jocano 1975 : 233), and that they were captured and eaten. This pattern of use of water buffalo has also been observed ethnographically. At the beginning of the twentieth century, herds of feral water buffalo foraged in the forested hills near Kalinga villages in northern Luzon (Jenks 1905 : 108). Although they were engaged in intensive wet rice agriculture in elaborate terraces, the Kalinga used water buffalo only for feasting and cultivation was carried out by hand. Taylor (1934) noted the presence of feral herds in other regions of Luzon. This suggests that water buffalo were able to adapt to the tropical environment of the Philippines without human intervention and could have survived as a wild population.

Cattle

Cattle are apparently latecomers to the Philippines. Radiating out from the center of domestication in the Near East (Flannery 1969), cattle were introduced into the Philippines from China and Mexico late in the sixteenth century (Scott 1990 : 302). Little is known about the impact, if any, on the traditional economy.

Horses

Originating on the Central Eurasian steppes (Clutton-Brock 1981), the domestic horse, *Equus caballus*, may have come into mainland Southeast Asia overland or via ocean routes and hence into the island archipelagos. It is unlikely that horses were introduced into the Philippines before the beginning of the present millennium. Horses are not mentioned in the Spanish chronicles. They are not well adapted to equatorial tropical climates and probably required human intervention to maintain pasturage. They may have increased in importance after Spanish colonization, when roads were created and traction was needed to transport people and materials.

The ethnohistorical information about prehispanic societies in the Philippines indicates that animals were incorporated into economy and ritual in different ways. Two elements that appear to be important considerations were availability and size. Animals such as deer, which were of significant size but were not reliably available, may have been opportunistically consumed, but do not appear to have figured significantly in ritual. Other taxa, such as fish, pigs, and chickens, which were smaller but probably more reliably available, were used in both nonritual and ritual contexts. Water buffalo were mentioned primarily in feasting contexts, but they did not figure as an element in trade.

FAUNAL SAMPLES FROM FOUR ARCHAEOLOGICAL SITES

The four faunal samples examined here come from several ecological and cultural contexts and time periods. The oldest is from Sohoton I, a cave site in Samar. Basal layers of this site were dated to 10,500 B.P. (Tuggle and Hutterer 1972). It has been suggested that this is a hunter-gatherer site. The other hunter-gatherer sample in this study comes from the Pintu/Busibus Rock Shelter in northeastern Luzon. Basal layers are insecurely dated to 4120 B.P. (Peterson 1974*b*); new dates for this important site are needed. Peterson suggested that the rockshelter was used for habitation, but a recent reanalysis of the lithic materials raises the possibility that it was an extractive locus focused on production of basalt blanks (Latinis 1996). Both sites are on the eastern side of the Philippines and, thus, are located in the same climatic zone (see Fig. 1). This climate is characterized as being wet and rainy throughout the year with a very short dry season, 1.5 months at most (Flores and Balagot 1969 : 200).

The samples from habitation sites in complex chiefdoms come from the Tanjay site in eastern Negros and the Cebu City site in eastern Cebu. Both of these sites date to the second millennium A.D. The Cebu City site brackets European contact. They are both located in a similar, drier climate zone where there is a 4.5 month dry season (Flores and Balagot 1969 : 202). Samples from these sites provide an opportunity to compare animal utilization through time and between groups of varying cultural complexity.

Sohoton I Cave[2]

The Sohoton I Cave site is one of several caves located in southwestern Samar in the western Visayan Islands (see Fig. 1). Unlike Negros, Cebu, and Luzon, there are no mountainous cordilleras on Samar. The interior is composed of an uplifted igneous plateau that is deeply dissected. There is also little lowland area; most is concentrated in a narrow coastal strip and in the lower deltaic regions of major rivers (Tuggle and Hutterer 1972 : 7). The Sohoton Caves are located on the Basey River, in a transition zone between the upland plateau and lowland alluvial plain. The basic limestone-derived soils of the transition zone support a dipterocarp forest that is more sparse and of different composition than the dense dipterocarp forests on the acidic igneous soils. The caves are 25 km upriver from the alluvial plain at the mouth of the river and several kilometers downstream from a lobe of the igneous plateau (Tuggle and Hutterer 1972 : 3).

The faunal material discussed here comes from all units excavated in Sohoton I

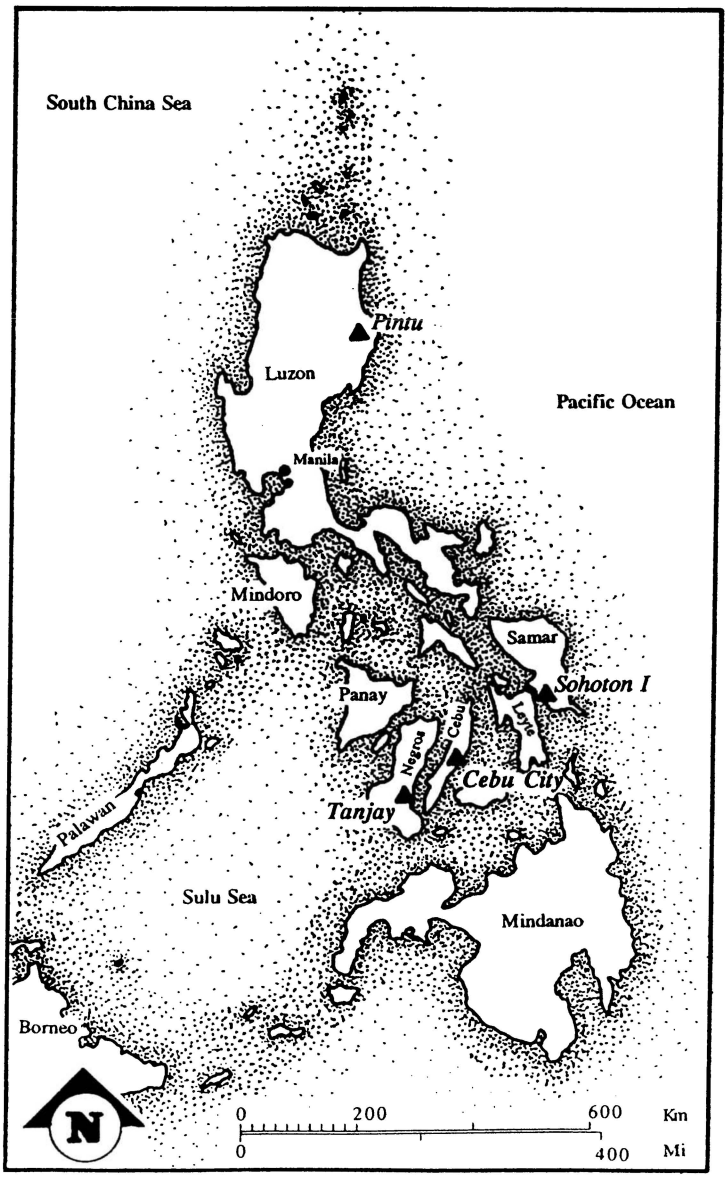

Fig. 1. Location of archaeological sites in the Philippines that yielded faunal samples discussed in text.

Cave in 1971 by Tuggle and Hutterer (1972). Eight 1.5 m^2 units were excavated by natural level to a maximum depth of 120 cm. The excavators divided the 120 cm deep excavation sequence into seven stratigraphic levels and three cultural levels, primarily on the basis of presence or absence of major classes of artifacts. The basal cultural stratum (120–40 cm below surface) contained only flake tools and animal bones. The bottom of this level was dated to 10,500 B.P. (Tuggle and Hutterer 1972:11). The second cultural stratum (40–10 cm below sur-

face) contained flake tools, earthenware pottery, and bones. The top few centimeters contained a few iron objects in addition to these other categories of artifacts. There appear to have been two major periods of occupation of the site that entailed animal utilization. The first period corresponds to the lowermost stratigraphic levels and the second period consists of the uppermost levels.

The excavators suggest that the cave was used primarily as a temporary shelter for hunter-gatherers. Although closest to riverine gallery forest, occupants of the Sohotan Caves would also have had access to resources in the dominant tropical forest through which the river ran. The karstic zone in the immediate vicinity of the cave is too rugged for agriculture. Animal resources would have included pigs, deer, monkeys, snakes, lizards, and birds.

Pottery was recovered only from the upper 40 cm of the deposits and may represent a period of contact with agriculturalists. Hutterer (1973) suggests that exchange was initiated by individuals who traveled upriver to contact hunter-gatherer groups, presumably for trading purposes. Thiel (1980:134) notes that these deposits of pottery could have been the product of visits by agriculturalists who used the cave while hunting. One of the goals of this analysis is to test these hypotheses.

Results — A total of 3562 bone fragments were examined, of which 289 or 8 percent were identified to taxon. All material was passed through 0.3175 cm (1/8 in.) mesh screen (Hutterer 1973:86). The sample was sorted into "unidentifiable" size and element categories and "identified" elements. These were counted but not weighed (see appendix for a discussion of methods).

The sample was dominated by the presence of pig and deer bones in almost equal proportions (see Table 1). These two taxa constitute the majority of the identified portion of the sample. Based on present species distributions, the deer is identified as *Cervus mariannus*, but no frontal-nasal bones were recovered to verify this assumption. The species of pig has not been determined. No lower canine teeth from males were recovered, the only element distinguishable between *Sus barbatus* and *Sus scrofa*. An unidentified large mammal was also present in the sample. None of the elements could be identified, although Ziegler (n.d.) is of the opinion that they are elements from a terrestrial rather than a marine mammal. His analysis shows that they represent two proximal metapodial elements, which can be identified as coming from a large bovid, most likely the water buffalo, *Bubalus bubalis*, because tamarao were not found in the western Visaya Islands, and there is no record of domestic cattle in the Philippines until after Spanish contact.

One element of *Cynocephalus volans*, flying fox, was found in the excavations. These animals, although relatively small, are edible and have a distinctive reddish pelt. No other arboreal mammal, such as fruit bat or monkey, was identified in the sample. A small number of reptile elements, including python (*Python reticulata*), lizards (*Varanus* sp. and *Hydrosaurus pustulatus*), and a turtle, were recovered. All four taxa are edible and the last three were probably introduced to the cave through human agents. Pythons, however, frequently occur naturally in caves and rockshelters and may have been accidental inclusions in the sample.

Three elements of the avian family Bucerotidae, the hornbills, were identified. These relatively large birds could have been a source of meat; they also have dis-

TABLE 1. COUNTS OF FAUNAL REMAINS FROM SOHOTON I CAVE AND PINTU ROCK SHELTER

	SOHOTON I CAVE						PINTU ROCK SHELTER					
LEVEL	1	2	3	4	5+6	7	1	2	3	4	5	6
Mammals												
Cynocephalus volans	1											
Cynopterus sp.				1								
Unidentified bat	2	1			1							
Sus sp.	7	35	19	7	16	9		3	43	61	12	4
Cervus mariannus	3	35	29	5	10	8	1	2	26	94	31	3
Macaca fasicularis									4	2	1	
Bubalus bubalis								2		1	1	
Large mammal	3	30	51	14	49	12			1	1	2	1
Medium mammal	5	27	23	6	28	3	3	7	255	182	242	38
Small mammal	6	32	5	8	5	5						
Subtotal	27	160	127	38	112	37	4	14	329	341	289	46
Birds												
Corvidae					1							
Bucerotidae		2	1									
Unidentified bird	4	7	13		6							
Subtotal	4	9	14		7							
Reptiles												
Python reticulata		19	10	2	13			5				
Hydrosaurus sp.			2	2	3							
Varanus sp.		5	1	2	4							
Turtle		3	3						1			
Subtotal		27	16	6	20			5	1			
Fish												
Dasyatidae			1		1							
Lutjanidae	3	3	1	4	2							
Sparidae		9		2								
Pomadasidae				1								
Unidentified fish	7	157	28	21	105							
Subtotal	10	169	30	28	108							
Unidentified vertebrate	69	661	544	191	914	131						
Totals	110	1026	731	266	1161	168	4	19	330	341	289	46

tinctively enlarged bills. An unidentified passerine (songbird) and corvid (family Corvidae, ravens and crows) were also identified.

Fish bones were relatively common. A total of 348 elements were examined, but only a small portion of the sample, consisting solely of marine taxa, were identified. Cranial bones of sparids (Sparidae), snappers (Lutjanidae), and grunts (Pomadasidae), as well as a sting ray (Dasyatidae) spine, were identified. Given the proximity of the cave to the river, freshwater species were undoubtably present but were not identified because of the limitations of the comparative collections available.

Discussion — Through comparisons of distributions of taxa and body parts, this faunal sample can be used to examine the economic activities at Sohoton I Cave

in more detail, as distribution of faunal remains may directly or indirectly reflect the activities performed at the cave. The relative proportions of pig to deer bones change little throughout the stratigraphic sequence. If the area around the cave had been deforested and converted to agricultural fields, we would see an increase in pigs, which are attracted to crops, and a decrease in deer, which withdraw from disturbance. As the proportions remain relatively stable, we conclude that the area underwent little or no ecological change during the time period represented by this sequence.

There are two possible sources for the terrestrial mammals recovered from the Sohoton I excavations, domestic and wild populations. The deer elements are undoubtably from wild populations. The pigs may come from either wild or domestic populations, and according to current knowledge about the history of large bovids in the Philippines, the water buffalo derive from domestic populations. Therefore, if the ways in which bones from these taxa were introduced into the cave varied predictably, then these patterns will be reflected in the composition of the assemblage.

Individuals from domestic populations of pigs and large bovids were probably slaughtered at the location where the live animals were maintained and their bones brought to the cave attached to meat. If so, we expect to see high meat-yielding elements present in the assemblage. Animals from wild populations, especially medium and large species, may have been butchered at or near the cave. If Sohoton was a hunting base, however, bones attached to large muscle masses would have been transported away from the cave and low meat-bearing elements left behind as part of the debris from butchering.

Table 2 shows the distribution of body parts at the Sohoton I Cave site. Medium mammals show a preponderance of skull elements and low meat-bearing bones (metapodials, carpels, tarsels, and phalanges). Few ribs, vertebrae, and high meat-bearing limb elements were identified. When identified pig and deer elements are considered, the same pattern prevails. Comparatively few numbers of meat-rich bones were recovered in relation to the number of meat-poor elements. If we assume that bias has not been introduced into the sample through differential preservation of low meat-bearing elements, then we may conclude that this distribution conforms to our expectations for the distribution of bones from animals butchered in the vicinity of the cave. The lack of vertebrae and ribs may indicate that carcasses of these medium taxa were transported away from the sites relatively intact, with the limb girdles still attached to the axial skeleton. The similarity of the distribution of the pig elements, whose derivation is unknown, to the wild deer suggests that the pigs are also from a wild population.

When this distribution is compared to the distribution of body parts of large bovids in the Sohoton I Cave site, a slightly different pattern emerges. Instead of a relatively high incidence of meat-bearing bones, as predicted were the bones from a domestic population, there is a preponderance of meat-poor skull parts and vertebrae (see Table 2) commensurate with an interpretation of on-site butchering of large animals. Even if transported by boat, large bovid carcasses would have been too massive to transport intact. It would have been more expedient to separate the appendicular elements from the axial skeleton and transport the limbs separately, leaving skull and backbone behind. Of the identifiable large bovid elements, one is fetal and the other is a metapodial; both are low meat-bearing bones.

TABLE 2. DISTRIBUTION OF COUNTS OF BODY PARTS FROM EXCAVATIONS AT SOHOTON I CAVE

	1		2		3		4		5+6		7	
LEVEL	N	%	N	%	N	%	N	%	N	%	N	%
Sus barbatus												
Skull	5	71	16	46	7	37	5	71	8	50	5	71
Limbs-high			2	6	1	5			1	6		
Limbs-low[a]	2	29	17	48	11	58	2	29	7	44	2	29
Total	7	100	35	100	19	100	7	100	16	100	7	100
Cervus mariannus												
Skull	1	33	15	43	16	55	4	80	7	70	4	50
Limbs-high	1	33	1	3							2	25
Limbs-low[a]	1	33	19	54	13	45	1	20	3	30	2	25
Total	3	99	35	100	29	100	5	100	10	100	8	100
Medium mammal												
Skull	1	20										
Vertebrae	3	60										
Limbs-high	1	20	8	30	7	39	1	17	8	28	2	40
Limbs-low[a]			19	70	10	55	5	83	20	72	3	60
Ribs					1	6						
Total	5	100	27	100	18	100	6	100	28	100	5	100
Large mammal												
Skull			4	13	3	6	1	7	2	4	1	8
Vertebrae	2	66	15	50	31	61	8	57	34	69	5	42
Limbs-high			3	10	1[b]	2						
Limbs-low[a]												
Ribs	1	33	8	27	16	31	5	36	13	27	6	50
Total	3	100	30	100	51	100	14	100	49	100	12	100

[a] Consists of metapodials, phalanges, carpels, and tarsels.
[b] Fetal.

Overall, the faunal evidence is consistent with the interpretation that the Sohoton I Cave was used as a hunting camp for people living elsewhere. The presence of marine taxa of fish in the assemblage suggests that these visitors lived on or near the coast and brought the fish with them to the cave. While it was not possible to identify all the fish elements in the assemblage, representatives of a number of marine families, including sparids, snappers, and groupers, were present. Marine fish bones were not concentrated in the upper levels, but were found throughout the stratigraphic sequence at the site. This distribution indicates that access to marine resources was maintained throughout the history of use of the cave.

The cave's occupants caught and presumably consumed a number of small taxa, including birds and snakes. They also hunted larger taxa: deer, pigs, and water buffalo. The pattern of meat-bearing bones in this assemblage indicates that these larger species were slaughtered in the vicinity of Sohoton I Cave and that meat was transported away from the cave, leaving low meat-bearing elements and butchering refuse behind. The stable proportions of pig to deer bones throughout the occupation of the cave suggests that agriculture was not practiced in the immediate vicinity. Therefore, the bones at the cave, including the large mammal bones, may have been from feral and/or wild populations.

Large bovid bones occur throughout the entire sequence of the cave's utilization, whose initial levels are dated to 10,500 B.P. If this date is associated with the earliest occurrence of the large mammal bones, then water buffalo may have been introduced into the Philippines at an earlier time period than previously thought.

Pintu/Busibus Rock Shelter[3]

The Pintu/Busibus Rock Shelter is located in northeastern Luzon, in Nueva Vizcaya Province (see Fig. 1). Although the site is only 25 km from the seacoast, it lies on the eastern side of the Sierra Madre. It is situated on the Ngilinan River, a tributary of the Cagayan River (Peterson 1974*a*). Pintu/Busibus Rock Shelter is a shallow limestone cave on a bend in the Ngilinan River where a depositional terrace has formed. At the location of the cave, the river runs through dipterocarp forests.

The site was investigated by Peterson in 1968–1969. A total of 104 m^2 was excavated to a maximum depth of 1.75 m. Excavations were placed both inside and outside the mouth of the cave. A total of 11 sediment layers were recognized; of these, eight contained cultural materials. The lowermost, layers 11 through 8, were sterile or yielded only a small amount of material. Site occupation coincided with the position of layers 7 through 1. Significant quantities of lithic materials and earthenware pottery were recovered from these layers.

Unreliable ^{14}C dates from layers 10 through 4 suggest that the site was first inhabited around 4120 B.P. and abandoned around 2110 B.P. No metal or Asian ceramics were found; two glass beads, however, were recovered in layers 4 and 5. The lack of metal or stonewares implies that the site may have been used before the incorporation of Philippine societies into long-distance trade networks with mainland Asia. Alternatively, lack of trade goods may indicate that the people using the rockshelter were not involved in long-distance trade. Peterson (1974*b*) has argued that habitation at the site was by "broad spectrum" hunter-gatherers who visited the site on a seasonal basis for an extended occupation.

Results — A total of 1029 bones was examined for this study, of which 296, or 29 percent, were identified to specific taxa. The major portion of the sample discussed here, 85 percent, came from Layers 3 and 4, which postdate 2100 B.P., most of which were concentrated both inside and at the mouth of the cave. The most common taxa represented in this sample is deer, represented by 157 elements (see Table 1). Based on present species distribution, the deer is identified as *Cervus mariannus*. No frontal-nasal bones were recovered, however, to verify this assumption.

Pigs are the second most common taxon in the sample, represented by 123 bones. A single male lower canine was recovered whose I/P ratio was 1.30, indicating that the tooth is from a bearded pig, *Sus barbatus*. Several elements of water buffalo, *Bubalus bubalis*, are also present in the sample from Pintu/Busibus Rock Shelter. A proximal radius-ulna was recovered from Layer 5, a mandibular ascending ramus from Layer 4, and several teeth from Layer 2. When compared to measurements of the same element from a domestic Indian water buffalo and a domestic water buffalo from Southeast Asia (see Table 3), the archaeological radius-ulna specimen is smaller in all measured dimensions. It was not possible to measure the ascending ramus.

TABLE 3. MEASUREMENTS OF WATER BUFFALO RADII AND ULNAE

	RADIUS PROXIMAL BREADTH (MM)	ULNA PROXIMAL BREADTH (MM)
Pintu Rock Shelter	80.6	37.2
Southeast Asia (NMNH 152159)	84.0	50.5
India (NMNH 54766)	105.6	59.4
India (NMNH 54765)	109.9	62.5

The macaque (*Macaca fasicularis*) is represented by teeth and limb bones. Two distal left humeri were recovered, representing two individuals. Both were from Layer 4. Other elements were found in Layers 3 and 5. Several reptile taxa were identified, including a single element of a soft-shell turtle and three python (*Python reticulata*) vertebrae. It is unclear how they were introduced into the cave.

Discussion — The lithic evidence from the Pintu/Busibus Rock Shelter indicated to the investigator (Peterson 1974*a*) that the cave was used by hunter-gatherers for extended occupation. Latinis (1996) suggests that the lithic materials are the product of quarrying and the initial reduction of cobbles for transport elsewhere. The faunal sample from this site may provide additional information regarding the season and nature of cave occupation, whether a base camp or special function site.

The range of species in the assemblage can give some indication of the time of year of occupation. The Pintu/Busibus Rock Shelter is located in a climatic zone with a pronounced wet season. During months of high precipitation (October through February), streams and rivers are swollen, making spear-fishing dangerous and line-fishing and netting unproductive. Birds and lizards may also be less active during the wet season and more difficult to procure. Active pursuit hunting of terrestrial game, however, is more productive during the wet season than during the dry season, as it is easier to move quietly through wet duff on the forest floor (Griffin 1984). There is a relatively narrow range of species represented at the Pintu/Busibus Rock Shelter. No fish, lizards, or birds are present in the recovered material. Nonmammalian bones have distinctive bone structure and if they were present in the sample, they would have been recognized even as relatively small bone fragments. The restricted range of species identified from this site suggests that the primary season of occupation was during the rainy season.

If the Pintu/Busibus Rock Shelter was used as a limited occupation site or as a hunting camp for populations that maintained habitation elsewhere, animals were probably killed and butchered in the vicinity of the cave and the meat-bearing bones transported away from the kill site. Therefore, we would expect to recover a relatively high percentage of low meat-bearing bones (skull, vertebrae, metapodials, carpels, tarsels, and phalanges) at the site. If, however, the site was occupied for a long period of time by domestic units, we would expect to recover a relatively high proportion of meat-bearing bones, reflecting kills brought in from elsewhere or, if animals were killed near the base camp, the presence of both high and low meat-bearing bones. The identified pig and deer bones from layers 3 and 4 at Pintu/Busibus Rock Shelter consist of both high and low meat-bearing elements (see Table 4). At the same time, unidentified vertebrae, ribs, and skull parts

TABLE 4. DISTRIBUTION OF COUNTS AND WEIGHTS OF BODY PARTS OF IDENTIFIED AND UNIDENTIFIED MEDIUM MAMMALS FROM LEVELS 3 AND 4, PINTU/BUSIBUS ROCK SHELTER

	LEVEL 3				LEVEL 4			
	#	%	WT. (G)	%	#	%	WT. (G)	%
Sus barbatus								
Skull	37	86	59	83	47	85	131	59
Limbs-high	3	7	4	5	11	18	81	37
Limbs-low[a]	3	7	9	12	3	5	9	4
Total	43	100	72	100	61	100	221	100
Cervus mariannus								
Skull	6	23	22	21	65	69	94	23
Limbs-high	14	54	154	79	16	17	262	63
Limbs-low[a]	6	23	19	10	13	14	57	14
Total	26	100	195	100	94	100	413	100
Medium Mammal								
Skull	21	8	19	9	6	3	3	1
Vertebrae	6	2	14	6	7	4	13	5
Longbones	228	90	180	85	163	90	245	93
Ribs	0	0	0	0	6	3	4	1
Total	255	100	213	100	182	100	265	100

[a] Consists of metapodials, phalanges, carpels, and tarsels.

were also present, although longbone fragments predominated both by count and weight. This is consistent with an interpretation of cave occupation as a base camp or as intermittently occupied for both extended and limited periods of time.

Several elements of water buffalo were identified. The presence of low meat-bearing skull parts suggests that the animal was killed in the vicinity of the cave, rather than transported to the shelter. The small size of the measured element does not indicate if the animal derived from a domestic or feral population. There are a number of unidentified bone fragments of a large mammal in the sample, which are probably also from water buffalo (see Table 1). Although the dating is not secure, lack of Asiatic trade wares suggests that the age of the sample predates extended contact with the Asian mainland. Again, the presence of water buffalo bones in a site from this pre-Contact period suggests that this species was introduced at an earlier time and that water buffalo populations were established in the Philippines well before the beginning of the present millennium.

The faunal evidence from the Pintu/Busibus Rock Shelter is consistent with an interpretation that this was a habitation site. The restricted range of species represented and, especially, the absence of fish in the assemblage suggest that the rock-shelter was inhabited by foragers during the rainy season.

The Tanjay Site[4]

The Tanjay site is located on the Tanjay River on Negros Island (see Fig. 1). The river drains the most extensive lowlands on the eastern side of the island, encom-

passing a region of more than 300 km^2. The watershed of the Tanjay River includes wooded rocky uplands, the evergreen forests of the lowlands, and nipa and mangrove swamps at the river's mouth. It winds through the only fertile lowland alluvial plain on the eastern side of Negros (Junker 1990:417). This was mostly deforested prior to Spanish contact and supported a variety of crops, including coconut, sugarcane, and rice. The uplands were covered with primary tropical rainforest dominated by dipterocarps. Although the prehistoric settlement was located at the river mouth, the current city of Tanjay, which overlies the prehistoric settlement, is more than a kilometer from the coast. The Tanjay River has been aggrading since the conversion of lowland forests to agricultural fields in the prehistoric period.

Excavations within the municipality of Tanjay were undertaken by Hutterer and Macdonald in 1981 (Hutterer and Macdonald 1982) and by Junker in 1985 (Junker 1990). Although the excavators located sparse cultural deposits dating to the earliest phase of habitation, the main foci of investigation were the post–A.D. 1000 Santiago and Osmena phase occupations. Two main areas within the Tanjay site were chosen for investigation: the Santiago Churchyard and Osmena Park. The excavation materials were analyzed in conjunction with results of regional settlement survey to yield a framework for comprehension of the development of a lowland Philippine chiefdom (Junker 1990).

During the Santiago phase (A.D. 1000–1400), Tanjay was the chiefly center of a complex settlement system. The center was 10–15 ha in size and located on the south bank of the Tanjay River. Intrasite comparison of deposits dating to this time period suggests that elite members of this prehispanic society were physically segregated from lower status individuals (Junker 1990). Ethnographic and ethnohistorical data suggest that the social elite of prehispanic Philippine lowland societies maintained large residences with fortifications that served as refuges during raids and as symbols of high status. Excavations at the Santiago Church locale uncovered portions of a large residence surrounded by a stockade and ditch. There is also evidence of ceramic production associated with the Santiago Churchyard excavations. No house compounds dating to this time period were identified from excavations at Osmena Park, but comparisons of Asian trade ceramics and decorated, locally made earthenwares demonstrate that fewer of these status indicators were found at this location than at the Santiago Churchyard (Junker et al. 1994), indicating that this area was occupied by people of lesser status.

In the succeeding Osmena phase (A.D. 1400–1600), Tanjay maintained its position as the chiefly center of the society. The settlement was 30–50 ha in size; occupation was on both sides of the river. As in the previous period, physical separation of elite residences appears to have been maintained. Portions of three large house compounds were uncovered at the Santiago Church locale; at least one was associated with portions of a ditch and stockade. Four house compounds were uncovered at Osmena Park; no feature identified as a stockade or ditch was found. Comparison of the sizes of the compounds and diameters of house posts indicate that the overall compound dimensions and building materials were larger at the Santiago Church locale. As in the previous period, higher densities of Asian ceramics and decorated earthenwares were found here. This evidence suggests that the Santiago Churchyard was the site of elite housing and Osmena Park was

the focus of lower status habitation during the Osmena phase of occupation at the Tanjay site.

Results — The samples discussed here come from two habitational locales at the Tanjay site. A total of 726 bones from the Santiago phase and 1851 bones from the Osmena phase were examined from the Osmena Park locale; 313 bones from the Santiago phase and 1644 bones from the Osmena phase were examined from the Santiago Church locale. These samples came from a variety of habitational features, including hearths, pits, general midden, and ditches associated with stockades around houses, but are considered as components of a single assemblage here.

The most common species identified at the site is pig (see Table 5). Subsistence farmers pioneering in upland areas of Negros in the 1940s recalled that domestic pigs were used as a source of cash (Mudar 1982) and that wild game was the main source of protein within the household. Domestic pigs were sold in the nearest market, sometimes almost a full day's walk away. Examination of patterns of disposal of other domestic animals raised for meat indicates that males were killed shortly after adult stature was attained and that females were killed after they ceased breeding (Payne 1973). It is not known at what age primitive domestic pigs attained their full size. If domestic pigs in prehistoric Tanjay were kept for meat, they would have been slaughtered at a relatively young age, so we would expect to see a relatively narrow range of ages in the resulting mortality profile.

Subsistence farmers in Negros often trapped pigs in spring-release spear traps (Mudar 1982). The mortality curve of wild pigs that are trapped might reflect the actual age structure of the population, as capture is largely a function of encounter rates. In this case we would expect to see a mortality curve consisting primarily of adult pigs, because piglets do not forage as far as adults and, being smaller, may elude spring-release spear traps (which were set about knee high). Ethnographic study of Agta hunters, who hunt pigs with bow and arrow, suggests that active pursuit hunting will also produce a characteristic mortality pattern (Mudar 1985). This mortality curve consists of relatively young and relatively old individuals. Although the encounter rate is a function of the percentage of the animals of different age classes in the population, the capture rate is higher for the oldest and younger age classes because these individuals are probably slower than prime adults and will be pursued longer by hunters.

Tooth eruption schedules for wild *Sus scrofa* were used to age the pigs from the Tanjay site (Matsche 1967). I assume that the eruption schedule for *S. barbatus* would not have been significantly different. All deciduous teeth (premolars, incisors, and canines) erupt by the nineteenth week of life and are lost by 22 months of age. Permanent teeth begin erupting at about 33 weeks of age, with the first molars and premolars appearing first. The last tooth to appear is the upper third molar, which does not erupt until the animal is more than two years old.

Pig teeth from Santiago and Osmena phases at the Osmena Park locale were examined for age determinations (see Table 6). There were 35 teeth from the Santiago phase, and 29 teeth from the Osmena phase, comprising both deciduous and permanent teeth. The presence of deciduous teeth in a sample indicates death rather than tooth shedding, as shed deciduous teeth are usually ingested by the animal. The mortality schedule of this population was assessed by comparing

TABLE 5. FAUNAL REMAINS FROM TWO LOCALES AT THE TANJAY SITE

	OSMENA PARK				SANTIAGO CHURCHYARD			
	SANTIAGO PHASE		OSMENA PHASE		SANTIAGO PHASE		OSMENA PHASE	
	N	WT. (G)	N	WT. (G)	N	WT. (G)	N	WT. (G)
Mammals								
Bubalus bubalis	1	2.8	5	80.3	5	227.0	9	255.1
Sus sp.	60	172.0	84	253.1	16	22.0	114	278.2
Cervus alfredi	22	74.3	6	28.4			14	39.2
Canis familiaris	1	0.6						
Macaca fasicularis	1	3.5	3	1.6				
Viverridae	1	0.2	2	0.5				
Fruit bat	1	0.1						
Subtotal	87	253.5	100	363.9	21	249.0	137	572.5
Birds								
Gallus gallus			2	1.3				
Unidentified bird	14	1.4	31	7.0	4	2.0	12	3.0
Subtotal	14	1.4	33	8.3	4	2.0	12	3.0
Reptiles								
Varanus sp.	1	0.4	2	3.0				
Dogania subplana			4	5.8				
Unidentified large turtle								
Python reticulata							1	0.5
Subtotal	1	0.4	6	8.8			1	0.5
Fish								
Scianidae	1	0.5	2	1.7				
Scaridae			3	1.4				
Serranidae	1	0.3						
Labridae	1	0.2	1	0.8				
Dasyatidae			1	0.9				
Ariidae			1	0.2				
Subtotal	3	1.0	8	5.0				
Unidentified large mammals								
Longbones	1	60.6	43	59.7	1	119.7	55	343.6
Vertebrae			1	4.3			1	6.0
Skull parts			3	7.5	20	117.4	20	91.2
Ribs	1	24.0	3	5.8	2	16.2	13	23.0
Subtotal	2	84.6	50	77.3	23	253.3	89	463.8
Unidentified medium mammals								
Longbones	371	88.9	1193	331.0	196	90.0	1198	629.9
Vertebrae	46	18.7	40	41.0	2	1.0	5	4.0
Skull parts	138	56.3	320	135.0	19	26.0	127	109.0
Ribs	18	8.5	34	13.2	3	3.0	9	7.0
Subtotal	573	172.4	1587	520.2	220	120.0	1339	749.9
Unidentified fish	46	5.3	67	16.0	43	13.0	62	16.0
Totals	726	518.6	1851	999.5	313	637.3	1644	1805.7

TABLE 6. MORTALITY SCHEDULES FROM TOOTH ERUPTION DATA FOR SUID REMAINS FROM OSMENA PARK LOCALE, TANJAY SITE

	SANTIAGO PHASE		OSMENA PHASE	
	N	%	N	%
5–8 months				
Deciduous				
Permanent counterparts	3	100	5	100
Molars	2		1	
8–12 months				
Deciduous				
Permanent counterparts	2	100		
Molars				
12–15 months				
Deciduous	2	33	2	66
Permanent counterparts	4	66	1	33
Molars	6		1	
14–16 months				
Deciduous	7	50	7	38
Permanent counterparts	7	50	11	62
Molars				
21–26 months				
Deciduous	1	33		
Permanent counterparts	2	66		
Molars			1	

numbers of deciduous teeth present in the sample to their permanent counterparts. Since the approximate ages of replacement are known, this gives an indication of the percentage of individuals who died before this age, as opposed to those surviving past that age.

The tooth data suggest that the majority of animals were killed before the age of 18 months. This would account for the presence of deciduous teeth in the sample, as well as the absence of late-erupting molars. A significant number of teeth (6/29 and 9/35) erupting between 12 and 18 months (PM 2, 3, 4; M2) were either unerupted and still contained in their bony capsule or unworn, indicating that death occurred within this narrow range of time. No teeth were recovered that were more than moderately worn, and only one of the late-erupting third molars was recovered. This suggests that there were no old individuals in the sample. Collectively, these data indicate that the population was managed and was probably a domesticated population. Thus the pigs are most likely to have been from the domestic pig, *Sus scrofa*. The other domestic mammal represented in this sample in significant numbers is the water buffalo (*Bubalus bubalis*), presumably domestic. Dogs are represented by a single element.

Deer is the most common wild species identified. Based on current biogeographical distributions, it is *Cervis alfredi*, identified by teeth and antler fragments and limb elements. All teeth are from adult individuals. Several elements of macaque (*Macaca fasicularis*) were recovered. The taxon was identified from a mandible from the Santiago phase, and two teeth and a fibula from Osmena phase deposits. One of the teeth may have been unerupted. The only bird to be identi-

fied was the chicken, *Gallus gallus*. Two elements were recovered from the Osmena phase, Osmena Park. Reptiles were identified in minor numbers. The monitor lizard (*Varanus* sp.), a soft-shelled turtle (*Dogania subplana*), and python (*Python reticulata*) were represented by a few elements. Both freshwater and marine fish were present at the site, but they were only partially identified due to restricted access to comparative fish skeletons.

Discussion — The physical separation of lower status from upper status residences at the Tanjay site provides an opportunity to examine ecological change through time while continuity in social circumstances is maintained. The aggradation of the Tanjay River is probably the result of deforestation of the lowland, which we expect to have affected the availability of wild terrestrial resources, especially deer. The build-up of the seacoast might also have affected availability of marine resources, increasing the time invested in procurement of marine fish. Thus as a result of changing environmental conditions we expect the faunal samples from the two time periods to vary in the number of wild terrestrial species and marine fish.

Representative samples from two time periods at the Osmena Park locale were used to examine changes in faunal utilization through time. During both time periods, the locale was occupied by non-elite portions of the population, and samples from both time periods come from the same types of contexts: domestic features and middens. Changes in faunal assemblage composition, therefore, cannot be directly attributed to shifts in social status of inhabitants or different depositional contexts. Slight differences in the composition of the two faunal assemblages were present (see Table 5) and may be linked to environmental changes. The decrease seen in the proportion of deer in the fifteenth–sixteenth century Osmena phase sample suggests that the extent of agricultural fields expanded over time. Only teeth and antlers were identified from the later sample, suggesting that antlers, perhaps attached to skulls, were traded as raw materials. These elements may have come from increasingly distant sources. There is also a slight increase in the number of identified marine fish through time. This may signify that access to marine resources was maintained despite the advancement of the Tanjay River delta. Overall, there was only minor change that can be attributed to changes in the natural environment in the composition of the assemblages from the two time periods.

To assess the effect of social context on faunal assemblages, the Osmena phase samples from Osmena Park and Santiago Church locales were compared. The samples are approximately comparable in size, as 1851 fragments, weighing 1000 g, came from Osmena Park and 1644 bones, weighing 1808 g, were removed from the Santiago Churchyard. The Santiago Church locale is thought to contain a high-status habitation area, as indicated by the presence of stockades, large houses, and higher percentages of decorated earthenwares. The Osmena Park locale was occupied by non-elite portions of the community. The composition of the assemblages is expected to reflect differential utilization of animal resources. In particular, ethnographic and ethnohistorical sources suggest that public destruction of domestic animals was an important element in competitive feasting to gain status among elites (Junker et al. 1994). Water buffalo and domestic pigs were frequently mentioned as sacrificial animals in these feasts. Thus we expect a

greater number of bones from these taxa at the Santiago Churchyard than at the Osmena Park locale.

Differences in the faunal assemblages from the two localities are apparent both in species composition and in body part distribution (see Table 5). The low-status faunal assemblage from Osmena Park has a greater diversity of wild species such as monkey, civet cat, and turtle, represented albeit in small quantities. These differences suggest that this portion of the population had greater access to wild species, perhaps through agricultural labors. The most striking differences in the assemblages pertain to distribution of water buffalo elements (see Table 5). Water buffalo were often consumed in prominent public feasts to gain and maintain status within lowland Philippine chiefly societies. Fifty-five buffalo bones weighing 158 g were recovered from Osmena Park (including unidentified large mammal bones, which are most likely water buffalo). This represents 15 percent of the sample by weight. In contrast, 98 large mammal bones weighing 779 g were recovered from Santiago Churchyard, 40 percent of the sample. The distribution of water buffalo parts in the two localities indicate that the inhabitants of the Santiago Church locale had greater access to water buffalo.

Distribution of body parts may also indicate differential access to faunal resources. Meat consumption can be monitored through identification of high meat-yielding/low meat-yielding bones. High meat-yielding bones include meaty portions of the appendicular skeleton, the pelvis and associated vertebrae, and shoulder girdles. Skull parts are usually considered low meat yield, but may be trophied. Ethnohistorical sources from the Philippines indicate that water buffalo skulls were often displayed as reminders of successful feasts. Comparison of the distribution of large mammal body parts (here assumed to be water buffalo) from Osmena phase contexts at Santiago Churchyard and Osmena Park yielded equivocal results. Quantification of results by weight contradicted conclusions based on quantification of results by count (see Table 7). The Osmena Park sample of large mammal bones contained 14 percent skull parts by count, but 55 percent by weight. Longbones comprised 78 percent of the sample by count, but only 37 percent by weight. The Santiago Churchyard sample of large mammal bone contained 26 percent skull parts by count, but only 22 percent by weight. The sample consisted of 59 percent longbones by count, but 74 percent by weight. These results show that skull parts were relatively large at Osmena Park locales, and that longbones were relatively large at the Santiago Church locale. In both samples, ribs and vertebrae were present in small proportions.

Comparison of unidentified medium mammal bones from Osmena phase contexts at the two locales shows a different pattern. There is a lower proportion of ribs, vertebrae, and skull parts, (i.e., low meat-yielding bones) in the sample from the Santiago Churchyard than from the Osmena Park both by count and by weight (see Table 5). This suggests that there was differential access to meatier pig body parts as well as to species of animals, which was at least partly a function of status differences.

Cebu City[5]

The prehistoric and early historic site of Cebu lies under the modern city of the same name. It is located on the narrow eastern coast of Cebu Island (see Fig. 1).

TABLE 7. COMPARISON OF THE DISTRIBUTION OF LARGE MAMMALS FROM FIFTEENTH- AND SIXTEENTH-CENTURY DEPOSITS AT THE TANJAY SITE AND THE CEBU CITY SITE

A. TANJAY

	OSMENA PARK				SANTIAGO CHURCH			
	N	%	WT. (G)	%	N	%	WT. (G)	%
Skull	8	14	88.0	55	26	26	171.4	22
Longbones	43	78	59.7	37	58	59	578.5	74
Ribs	3	5	5.8	3	13	13	23.0	3
Vertebrae	1	2	4.3	3	1	1	6.0	1
Total	55	100	157.8	100	98	100	778.9	100

B. CEBU CITY

	PLAZA INDEPENDENCIA	
	WT. (G)	%
Skull	39.9	2
Longbones	1208.4	65
Ribs	290.5	15
Vertebrae	327.2	18
Total	1866.0	100

The earliest settlement was located at the mouth of the Lahug and Guadeloupe rivers, fronting the Straits of Bohol. Molave forests dominated the landscape in the immediate vicinity of the site. Dipterocarp forests were found at higher elevations.

Despite the difficulty of conducting archaeology in an urban context, Nishimura carried out a project of survey and excavation in Cebu City in 1985–1986. Excavations were conducted at six locations throughout the city. Although he did not encounter deposits dating to the earliest occupation of the site in these excavations, geological studies have allowed Nishimura to propose a history of the settlement. The earliest settlement, about 2 ha in size and dating to the tenth century A.D., was located on a sandy ridge between the marine coast and a swampy area at the mouth of the rivers (Nishimura 1992:405). Nishimura proposes that Cebu assumed the position of the center of a chiefdom located on the island soon after the inception of the settlement. There is little or no evidence for agriculture having been practiced in the immediate vicinity of the settlement and Nishimura argues that, as the center, Cebu was supported by the surrounding hinterlands.

In the succeeding period, the site expanded to cover 20 ha, as the land in the vicinity of the seaward side of the settlement prograded and the swamp filled in. Nishimura posits that an increased sediment load in the rivers was the result of deforestation in the uplands of the region. Deposits dating to the early Late Prehistoric period (fourteenth–fifteenth centuries A.D.) were encountered in the excavations. During this time period Cebu was a powerful regional center, coordinating movement of goods through inter-island trade. It was also an important

center for international trade, as sailing vessels from mainland Asia regularly stopped at Cebu. By the end of the Late Prehistoric period (fifteenth–sixteenth centuries A.D.), at the eve of Spanish contact, the settlement was 30 ha in size (Nishimura 1992:408).

Cebu figured prominently in accounts of Spanish contact. Magellan was killed in 1521 during an encounter with Cebuanos on Mactan Island, just to the north of the Cebu settlement. The Spanish later established a trade center at Cebu, but eventually transferred trading activities to Iloilo on Panay Island before settling on Manila as the capital in 1571. Cebu, however, remained an important Spanish administrative center throughout the Spanish period.

Assemblages from two localities were chosen for analysis for the purposes of this study: Santo Nino Church and Plaza Independencia. Both locales yielded deposits dating from the Late Prehistoric period (c. A.D. 1350) through the late Spanish period (c. A.D. 1900). Nishimura suggests, on the basis of analysis of ceramic data, that habitation density at the Santo Nino Church locale increased after the early Spanish period (c. A.D. 1750) (Nishimura 1992:824). He argues that this local increase in population was due to the presence of the church, which was built shortly after colonization. Church construction and upkeep may have provided employment opportunities or access to other kinds of resources. Nishimura also demonstrates that test pits in the inside courtyard had lower densities of glazed ceramics than the other area considered here. This suggests that this area was occupied by groups with lower socioeconomic status during the Prehistoric periods (Levels 5 and 6).

The earliest cultural deposits at the Plaza Independencia date to the fourteenth century A.D. (Level 6). The nature of the artifacts suggests that this area supported domestic architecture during this time period. During the fifteenth and sixteenth centuries, this area may have been the living quarters and working area of ironsmiths. Both domestic debris and evidence of smelting were found during excavation (Nishimura 1992). The artifactual material associated with Plaza Independencia during this time period indicates that these craftsmen were fairly high status individuals. During the succeeding Spanish period (Level 4), Plaza Independencia became public land associated with Fort San Pedro and was not used for habitation.

Results — A total of 497 identified bones from two localities were selected for analysis for this study.[6] These localities, Plaza Independencia and Santo Nino Church, accounted for the majority of faunal elements from the excavations. The most common class of bones was fish bones (see Tables 8 and 9). At least 13 families are represented (see appendix for discussion of problems associated with the identification of fish bones). With few exceptions, the fish discussed here are identified to family level only.

The majority of fish identified inhabited shallow water reefs. This includes parrotfish (Scaridae), wrass (Labridae), triggerfish (Balistidae), snapper (Lutjanidae), surgeonfish (*Acanthurus* sp.), and croaker (Scianidae). These are the most commonly represented taxa in the sample. Other identified families include grouper (Serranidae), sparid (Sparidae), sea catfish (Siluridae), and garfish (*Tylosaurus* sp.)

Pig is the most common mammal to be identified, assumed here to be the domestic pig, *Sus scrofa*. Domestic mammalian species identified include water buffalo (*Bubalus bubalis*) and dog (*Canis familiaris*). One element of horse (*Equus*

TABLE 8. COUNTS AND WEIGHTS OF IDENTIFIED FAUNAL REMAINS AND WEIGHTS OF UNIDENTIFIED FAUNAL REMAINS FROM PLAZA INDEPENDENCIA, CEBU CITY

	LEVEL 3		LEVEL 4		LEVEL 5		LEVEL 6	
	N	WT. (G)	N	WT. (G)	N	WT. (G)	N	WT. (G)
Mammals								
Bubalus bubalis	2	71.6	2	10.0	2	58.0		
Bos taurus					1	24.3		
Sus sp.	4	3.1	23	26.2	44	156.0	2	2.3
Cervus sp.	1	7.3			1	0.3		
Canis familiaris			1	0.3	2	3.3		
Equus caballus			1	20.3				
Large mammal	2	118.1	2	11.8	23	566.2		
Medium mammal			1	10.1	2	21.7		
Total	9	200.1	30	78.7	75	829.8	2	2.3
Fish								
Scianidae	1	0.5	18	13.0	16	20.2		
Scaridae	1	1.5	26	15.0	39	34.5		
cf. *Sparisoma*			2	2.5	12	26.1	1	0.3
Serranidae			2	1.2	5	2.8		
Labridae	1	0.9	2	3.5	9	6.4		
Lutjanidae			7	4.0	4	4.6		
Balistidae								
Balistes sp.			11	7.9	14	25.0		
Sparidae								
Pagrus sp.			6	1.8	12	10.7		
Tylosauridae								
Tylosaurus sp.			1	0.4				
Chondrychthes (ray)					3	111.9		
Total	3	2.9	75	49.3	114	242.2	1	0.3
Bird								
Gallus gallus					2	0.7		
Reptiles								
Unidentified small turtle					3	2.6		
Unidentified large turtle			1	0.8	2	3.7		
Total			1	0.8	7	7.0		
Unidentified large mammal								
Rib		5.4		10.3		290.3		
Vertebrae		0.0		00.0		327.2		
Longbones		82.4		104.9		1208.4		8.6
Skull		4.8		34.1		39.9		
Total		92.7		149.3		1866.3		8.6
Unidentified medium mammal								
Rib				0.8		92.5		
Vertebrae		0.2		1.2		47.2		
Longbones		55.9		174.9		917.7		15.2
Skull		0.9		14.5		30.5		1.5
Total		57.0		191.6		1085.5		16.3
Unidentified fish		6.6		74.1		233.3		9.14

TABLE 9. COUNTS AND WEIGHTS OF IDENTIFIED FAUNAL REMAINS AND WEIGHTS OF UNIDENTIFIED FAUNAL REMAINS FROM SANTO NINO CHURCH, CEBU CITY

	LEVEL 3		LEVEL 4		LEVEL 5		LEVEL 6	
	N	WT. (G)	N	WT. (G)	N	WT. (G)	N	WT. (G)
Mammals								
Bubalus bubalis	2	25.3			1	6.9		
Bos taurus					1	2.1		
Sus sp.	22	60.0	13	27.6			4	9.5
Cervus sp.	1	1.8	1	1.6				
Canis familiaris	3	8.6						
Large mammal	2	33.1						
Total	30	128.8	14	29.2	2	9.0	4	9.5
Fish								
Scianidae	16	14.4	4	2.3	1	1.0	3	1.2
Scaridae	42	13.8	14	10.4	4	1.2	2	1.9
cf. *Sparisoma*	11	4.6	1	0.3				
Serranidae	3	1.2	2	0.5	1	0.3		
Labridae	2	0.7	1	0.1	1	0.1	4	2.3
Lutjanidae	2	0.2	3	0.3	1	0.4	1	0.3
Balistidae								
Balistes sp.	14	9.0	4	2.9	3	5.0		
Sparidae					1			
Pagrus sp.	8	1.4	5	0.6		0.3	8	2.1
Acanthuridae								
Acanthurus sp.	6	1.3						
Sea gar	1	0.2						
Ariidae	4	0.6	1	0.2				
Chondrychthes (ray)	1	2.8						
Total	100	50.2	35	46.8	12	8.3	18	7.8
Birds								
Gallus gallus	2	4.1						
Reptiles								
Unidentified large turtle	1	7.1						
Total	94	190.2	49	46.8	14	17.3	22	17.3
Unidentified large mammal								
Ribs		17.5		2.1				
Vertebrae		85.6						
Longbones		71.0						
Skull		15.1						
Total		189.2		2.1				
Unidentified medium mammal								
Ribs		2.5				0.1		0.3
Vertebrae		3.6		1.6				
Longbones		21.6		8.9		0.8		0.6
Skull		33.6		3.9		0.4		
Total		61.4		14.5		1.3		0.9
Unidentified fish		62.3		17.5		6.7		4.9

caballus) and cow (*Bos taurus*), several elements of deer *(Cervis* sp.), and chicken (*Gallus gallus*) were also identified.

Discussion — Examination of faunal remains from two locales of the 1985–1986 excavations at the Cebu site supports Nishimura's assessment of occupational history of the areas. The faunal assemblage from Plaza Independencia indicates that the occupants had access to both marine and terrestrial animal resources. A total of 25 water buffalo bones and large mammal bones (assumed to be water buffalo) were identified from Plaza Independencia, dated to the terminal Late Prehistoric period (fifteenth–sixteenth centuries A.D.) (Level 5) (see Table 8). A total of 44 pig bones, assumed here to represent domestic pig, were also identified. Fish were an additional important part of the diet, represented by nine families and/or genera.

The distribution of unidentified large mammal bones from Late Prehistoric contexts at Plaza Independencia was compared to the distribution at another elite area of occupation, the Santiago Church locale at the Tanjay site (Table 7). The two assemblages date to approximately the same time period, the fifteenth–sixteenth centuries. In both contexts, the proportion of longbone, by weight, was relatively high, 64–74 percent, especially when compared to the values recorded for areas occupied by non-elites. The percentage of large mammal longbones at the Osmena Park locale for the same time period of the Tanjay site was 37 percent. Unidentified medium mammal bones at the Plaza Independencia are also represented primarily by longbones. This suggests that elite individuals at Plaza Independencia had access to better-quality meat from both large and medium mammals.

The Santo Nino Church locality, in contrast to Plaza Independencia, was not heavily occupied until the early Spanish period (Level 3). Examination of the faunal assemblage indicates that marine fish and pigs were important elements in the diet of people living in the Santo Nino Church locality. Pigs were represented by 40 elements from all layers. Twelve taxa of marine fish were represented. There were no large mammal or water buffalo bones identified from the early time period at this locale. Large mammal bone weights for late Spanish occupations in the Santo Nino locale, however, indicate that the inhabitants had access to large mammals, albeit in smaller quantities than elite blacksmiths at Plaza Independencia the previous time period (see Table 9).

Fish were an important resource both at Santo Nino and at Plaza Independencia. The species compositions of the two assemblages, one later in time than the other, are essentially identical. Surprisingly, fish commonly caught in offshore fishing grounds today were not present in this sample, although these species possess massive and identifiable bones. If present in the original assemblage, we expect them to be preserved. The species of fish missing from this sample are primarily those which would involve outlay of capital and cooperation for their capture. Offshore fishing involves use of boats and, at the minimum, two or three people for a crew. Deep-water fish corrals require boats and materials in their construction and only last six months, as they are often destroyed each year in typhoons. Corrals are usually monitored at least twice a day.

The species composition of these samples suggests that coordinated energy was not expended on the capture of marine resources. Spoehr (1984:28) has argued

that in seventeenth- and eighteenth-century Manila, fishing techniques shifted from small-scale individual efforts to large-scale cooperative activities to meet the demands of a growing urban population. He has also noted that extensive offshore fishing is a colonial phenomenon: "During the Spanish colonial period Philippine fisheries were predominantly small scale and although enriched by the introduction of new types of gear from both Chinese and Spanish sources were, from a technological point of view, relatively static. Shortly before 1900, the *sapyaw (sapiao),* a round-haul seine, [appears] and somewhat later the deep-water fish corral, apparently both Tagalog innovations that spread to other parts of the archipelago" (1984:32). These, along with other, later innovations, shifted the focus of fishing from broad-spectrum, small-scale adaptations emphasizing near-shore resources to one in which offshore fishing dominated.

Analysis of remains from Spanish colonial Cebu suggests that patterns of fish exploitation in this community were parallel to those described for pre-twentieth-century Manila. Prior to the introduction of large seine net technology and deep-sea corrals, fishing efforts concentrated on near-shore reef environments. These techniques were probably adequate to supply the population of Cebu during the early Spanish (colonial) period.

A comparison of the faunal assemblages from Plaza Independencia and Santo Nino Church would be misleading, as effects of differences in socioeconomic status cannot be separated from effects of ecological change or impact of Spanish colonization. Some generalizations, however, may be offered. First, if Nishimura's assessment of the socioeconomic status of inhabitants of these locales is accurate, the presence of water buffalo signals elevated status in this society. Second, the stability in species composition of the identified marine fish through time indicates that Spanish incursion had little effect on the fishing methods in the area.

ANIMAL UTILIZATION IN THE PHILIPPINES

The faunal assemblages examined here span more than 10,000 years and represent both simple hunter-gatherers and more complex forms of social organization. They were retrieved from sites in coastal and inland contexts and in two different climatic zones. Although they represent only a tiny fraction of the sites occupied in the Philippines over this period of time, when viewed collectively, one of the most notable characteristics of the faunal assemblages is their stability in terms of key species composition. The terrestrial species that contribute to the unique aspect of each assemblage, such as birds, reptiles, and arboreal mammals, are represented by small numbers, often only one or two elements. The number of species commonly identified in the assemblages from all of the sites is limited, consisting of pig, water buffalo, and deer.

The core species in these assemblages appear to be deer and pigs, either wild or domestic. Sample size, however, can have a significant effect on species diversity. Grayson (1984) has considered the relationship between the number of identified bones (NISP) to the number of identified taxa in faunal assemblages, and he suggests that this relationship may be investigated empirically. Correlations between NISP and sample size can be examined through regression analysis.

The relationship between sample size and the number of taxa identified for each archaeological site was examined. NISP plotted against mammalian taxa

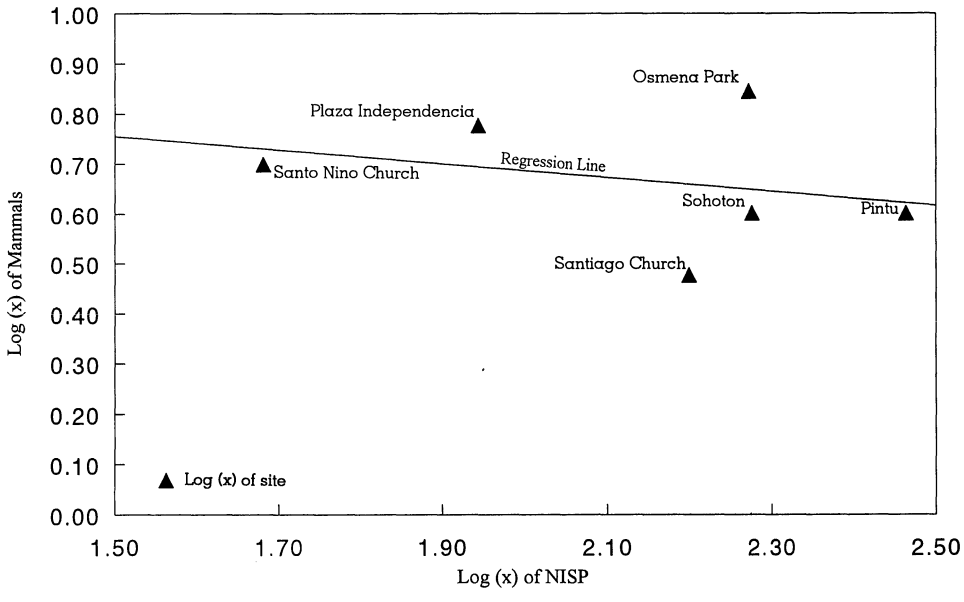

Fig. 2. NISP plotted against number of mammalian species identified from four archaeological sites in the Philippine Islands.

number did not show a pattern consistent with sample size effects (see Fig. 2). Only the comparison of the number of land species to NISP showed a positive but weak correlation (see Fig. 3). It is possible that the smaller samples drawn from the late prehistoric agriculturalist sites in Cebu and Negros underrepresent the diversity of mammals that may have been procured.

Pigs were present in all four sites. The pig, wild or domestic, was a central element of the diet. Wild pigs were relatively common and accessible to foragers in terms of density and formidability. Agriculturalists may also have taken advantage of wild pigs' fondness for domestic crops. The domestic species adapted well to the tropical environment and pigs may have even been more successful as a tropical domesticate than in the arid Near East. Redding (1991) argues that pigs will be maintained in the economy as long as there is sufficient surplus grain to feed them or if there are alternative food sources for pigs to subsist on. Domestic pigs in the Philippines were often fed plant food, such as chopped banana stalks, which were not customarily used by people for food (Mudar and de la Torre 1982). This may have minimized competition for grain between people and pigs.

Deer bones also occurred in all sites. Unlike pig and water buffalo, in complex societies in the Philippines deer is represented by only a few elements other than teeth and antler. This suggests that deer was used for food in forager contexts, but that skulls were curated among agriculturists for the attached antlers, which material was used for tools. This corroborates Spanish observations that deer was not a major source of food for lowland agricultural groups in the Philippines.

Water buffalo bones were found in the earliest strata as well as the latest. This suggests that the introduction of the water buffalo predates the time period considered in this study. Two alternative hypotheses might account for the introduc-

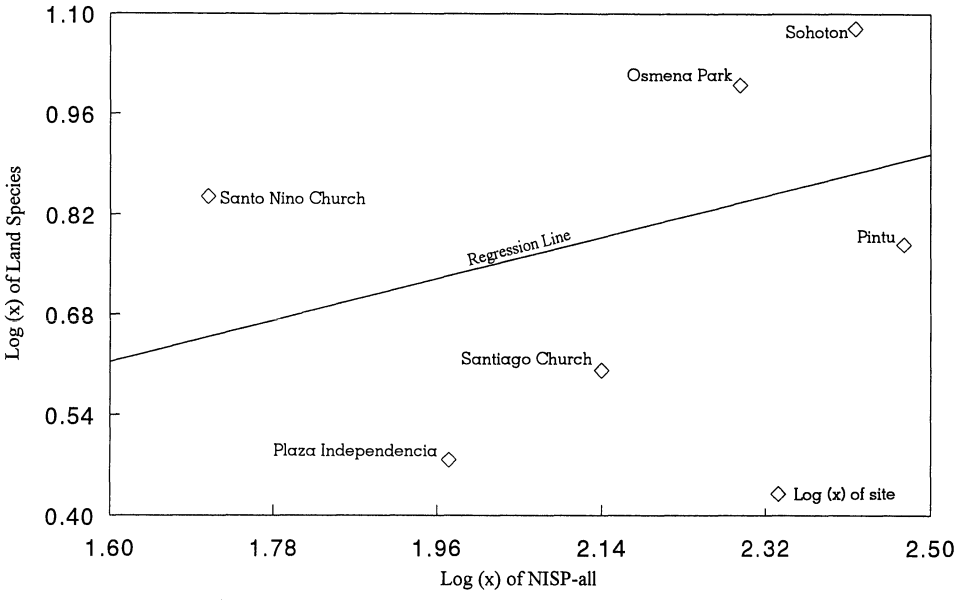

Fig. 3. NISP plotted against nonmarine vertebrate species identified from four archaeological sites in the Philippine Islands.

tion of this species into the Philippines. One possibility is that they were carried by human agency at a time period earlier than previously thought. Comparative linguistic work might provide evidence to refute or support this hypothesis. Another possibility is that wild water buffalo entered the Philippines without human intervention. The most likely time for this would have been during the middle Pleistocene, when the bearded pig migrated. This hypothesis would have to account for the establishment of wild populations on the large islands of Mindanao and Luzon, extirpation on the majority of the Visayan Islands, and maintenance of dwarf populations on Mindoro. The water buffalo radius-ulna from Pintu/Busibus Rock Shelter was smaller than counterparts from the Southeast Asian mainland, which suggests that some dwarfing had occurred in an established population. Limited fossil evidence suggests that water buffalo may have been present in the Philippines by the end of the Pleistocene. Shutler and Mathisen (1979) report that *carabao* have been identified from middle-Pleistocene deposits in the Cagayan Valley, Luzon. It is possible that these populations survived into the Holocene.

Marine fish were identified at three of the four sites, Pintu/Busibus Rock Shelter being the only exception. The Cebu City site had the largest number of identified marine fish, with smaller numbers at Tanjay and Sohoton I Cave. Cebu is directly on the coast, and Tanjay is situated on a navigable river near the sea, but even the Sohoton I Cave, several tens of kilometers from the sea, yielded marine fish bones. This has, no doubt, much to do with accessibility to coastal settlements and portability. Even in the tropics, fish can be preserved by drying, smoking, or salting in portions small enough for transport and trade.

At all of the sites, there were few species representative of deep-water fishing. Furthermore, there is little difference between the faunal samples from Santo Nino Church and Plaza Independencia in terms of species composition. This suggests that there was little early Spanish impact on marine exploitation. Limitations on exploitation of marine resources were largely technological in nature and not overcome until early in the twentieth century, when deep-water fish corrals and seine nets were introduced into the Visayas.

Unexpectedly, none of the sites examined here contained significant proportions of goat, chicken, or dog. Chickens, in particular, were often mentioned in Spanish chronicles and were significant components of the domestic economies of historic societies in the Philippines; their consistent absence from these assemblages is surprising. Chicken bones are fairly soft and may not preserve well. Dogs were ritual items in upland ethnohistorically documented Filipino cultures (Afable 1995) and may have been so in lowland cultures as well. Were dogs present in these settlements and consumed, I would expect to find their bones in domestic refuse. The low frequency of this taxa in the assemblages suggests that dogs did not become important resources until after Spanish contact. It is possible that dogs replaced traditional sources of protein in an economy that was disrupted by Spanish colonization.

Other species that the ethnohistorical records mention but which were not identified or identified in low numbers in these assemblages include goat, domestic cat, horse, and cattle. Cats and horses may not have been customarily eaten and, thus, are not present in domestic refuse. Goats were apparently more common in the southern part of the archipelago. Cows may not have become important as a food source until after the time represented by these samples.

Comparison of the distribution of medium ungulate body parts between Sohoton I Cave site and Pintu/Busibus Rock Shelter suggests that the occupation of the two sites differed. The assemblage from the Pintu/Busibus shelter includes identified and unidentified bones from all elements of the skeleton: skull, ribs, vertebrae, and high and low meat-bearing bones of the appendicular skeleton of both medium and large species. This suggests that hunting took place close to the rockshelter (or that intermittent habitation and provisioning occurred at the site). Lithic procurement and reduction activities identified by Latinis (1996) were apparently carried out within the context of such use, likely during the rainy season.

The assemblage from Sohoton I Cave is lacking in high meat-yielding bones, ribs, and vertebral skeletal medium mammal elements. A relatively high number of low meat-bearing longbones and vertebral elements from large mammals were, however, identified. This is consistent with preliminary butchering of animals transported elsewhere for consumption. People using the cave probably camped or lived elsewhere, and during the latest interval may not have been foragers.

CONCLUSIONS

The results of this study indicate that the array of animal species available for exploitation in prehispanic Philippine societies predates the emergence of complex lowland societies. Analysis of faunal assemblages from four sites indicates that

there was relative stability in exploitation of major species through time. It also indicates that Spanish colonization had little impact on the local economy until late in the historic era.

The presence of water buffalo bones in the early strata of Pintu/Busibus Rock Shelter and Sohoton I Cave challenges current interpretations of the biogeographic history of this species. Dating the bones directly would provide more accurate baseline dates for the introduction of the species. Finally, the premises for positing that the water buffalo was introduced into the Philippines by human means must be reexamined. The ancestor of the tamarao was able to successfully transverse the water gap between Sundaland and the Philippines during the Pleistocene; migrating throughout the Philippines would have been equally feasible. It is possible that successful populations were established on the large islands of Luzon and Mindanao, but were locally extirpated on the smaller islands.

None of the four samples examined here contained significant numbers of dog bones. Faunal analyses of other twelfth- to sixteenth-century A.D. lowland Filipino sites also yield small numbers of dog bones (Bautista and Galpo n.d.), which suggests that dogs were not commonly consumed, if at all, during the time periods and in the localities represented by these archaeological sites. There is also no mention of the use of dogs as articles of ritual, trade, or consumption in the Spanish chronicles. Consumption of dogs by some societies on festive occasions, however, was established by the early part of the twentieth century, as ethnographic documentation shows (Jenks 1905).

The position of dogs as a source of protein in the diet in historic Philippine traditional societies has not been adequately evaluated. The practice of eating dog meat was apparently not adopted until sometime after the sixteenth century, at least in the lowland Philippines. Research on dog consumption in native societies on the Great Plains of North America indicates that dogs became increasingly important as food items after traditional life-styles were disrupted through Euro-American colonization (Snyder 1995). It may be possible to draw parallels between Spanish colonization in the Philippines and Euro-American colonization of the Great Plains. An alternative hypothesis is that the image of cultural minorities in the Philippines as consumers of dogs has been manipulated to emphasize the distance between American and Filipino cultures of the early twentieth century (Afable 1995). Examination of faunal samples that date to the period between the first Spanish incursions in the Philippines and the twentieth century is needed to evaluate these hypotheses.

Contrary to expectations that the economic and ritual activities of traditional Philippine societies were significantly changed by the introduction of new species of mammals, analysis of four faunal samples indicates substantial stability in species composition through time. There is evidence for the early presence of water buffalo and pigs, both wild and domestic, in the archipelago. The greatest shift is in the use of deer, which appears to have been less accessible to lowland agriculturalists.

This study has compared differences in the distribution of taxa and body parts among two sites with early occupational components and two relatively late sites from complex chiefdoms. These comparisons have indicated that the use of key mammalian species—water buffalo, pig, and deer—has remained relatively constant through time, while the portions of these animals represented at sites of dif-

ferent ages have undergone considerable change. Absent from this study, however, are assemblages from agricultural societies that are intermediate both in time and social complexity to the assemblages examined here. Examination of faunal remains from early sites in simple agricultural systems, which may have been more directly affected by the introduction of new domestic species, would provide more information about the factors that promoted relatively stable reliance on a few mammals. While this study has provided information about the beginning and end of the process, inclusion of assemblages from excavations of early agricultural sites would provide a more accurate understanding of the origins and subsequent development of the differentiated economic basis of complex prehispanic Philippine societies.

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NOTES

1. The political entity of the Philippines includes Palawan. This island is not, however, part of the oceanic archipelago, but is located on the Sunda Shelf. It is, therefore, not part of the biogeographical unit of the Philippines and is not included in this discussion.
2. The sample from Sohoton I Cave was made available by Karl Hutterer and was initially analyzed by Alan Ziegler in 1972 (Ziegler n.d.). The collection was identified using collections at the University of Michigan Museum of Zoology. Assistance in identification was provided by Gerald Smith (fish), Philip Myers (mammals), Scott Moody (reptiles), and Robert Storer (birds). Further information about the Sohoton Caves is found in Hutterer (1973).
3. The Pintu/Busibus Rock Shelter sample was made available through efforts of Michael Graves and was identified using collections at the Smithsonian Institution, Vertebrate Zoology Division. This analysis was supported by a Postdoctoral Fellowship in Anthropology at the Smithsonian Institution. Assistance in identification was given by Marc Frank. Further information about Pintu/Busibus Rock Shelter is found in Peterson (1974*a*).
4. The Osmena Park assemblage was made available for analysis by Karl Hutterer. Identifications were made using comparative materials from the University of Michigan Museum of Zoology. The Santiago Church locale sample was made available by Laura Junker and was identified using collections at the Smithsonian Institution, Vertebrate Zoology Division. This analysis was supported by a Postdoctoral Fellowship in Anthropology at the Smithsonian Institution. The numbers published here differ in minor ways from those in Junker et al. (1994). The most significant difference is the inclusion of chicken bones in Santiago Church contexts. Further information about the Tanjay site is found in Junker (1990).
5. The Cebu City samples were made available by Masao Nishimura. The assemblage was identified using collections at the University of Michigan Museum of Zoology. Assistance in identification was provided by Gerald Smith (fish), Philip Myers (mammals), Scott Moody (reptiles), and Robert Storer (birds). Additional assistance in fish identification was provided by Melinda Allen. This assemblage is also discussed in Nishimura (1992).
6. Unfortunately, counts of the unidentified faunal remains were misplaced during several separate transpacific relocations by Nishimura and myself, and are not currently available.

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ABSTRACT

Using animal bone assemblages from four archaeological sites, the hypothesis that economies and rituals of prehispanic Philippine societies were restructured by the introduction of various species of terrestrial mammals is examined. Analysis of the faunal assemblages indicates that the primary mammalian species utilized were water buffalo, wild and domestic pigs, and deer. Sites near the coast also contained marine reef fish, but not deep-sea fish. There was unexpected stability in species composition through time, suggesting that water buffalo was introduced to the Philippines at a relatively early date. Dog bones were not identified from domestic deposits. Emphasis on consumption of dog in traditional Filipino societies may be a product of early twentieth-century ethnographic sensationalism, and the premises for this emphasis should be reexamined. Distribution of body parts within and between sites are examined to identify social differences within sites in chiefdom and differences in site utilization in hunter-gatherer sites. KEYWORDS: Faunal analysis, subsistence, Holocene, Philippines, Southeast Asian archaeology.

APPENDIX: METHODS

The faunal material from each site was first sorted into one of the taxonomic classes of mammals, birds, reptiles, and fish. Within each class, the bones were further sorted into "identified" and "non-identified" categories. Characteristics of each identifiable bone were recorded individually. The mammalian unidentified material, which constituted the bulk of all the samples, was first divided into size categories of large (cattle-water buffalo), medium (pig-dog-deer), and small (cat or smaller). Within each size category, the unidentified bones were further classified by body part: skull, longbones, vertebrae, or rib fragments. Skull fragments included teeth, in order to facilitate comparisons of body part distribution with skull parts containing teeth.

Unidentified fish were divided into categories of scales, spines, vertebrae, and skull parts, then counted and weighed. Osteologically, fish are difficult to identify to the species or even genus level and present a challenge to the zooarchaeologist working in tropical marine areas where the fish fauna are particularly rich. With few exceptions, the fish discussed here are identified to the family level only. Dentaries and maxillaries are the most common elements recovered. Fish with stout mouth parts, such as parrotfish and wrasses, are overrepresented in comparison to fish with more delicate bones. Dentaries and maxillaries are also the most common element identified, indicating that species more commonly represented by other body parts are not as readily identified, thus resulting in underrepresentation. The size of the comparative collection used also contributed to biased results, as a limited number of taxa were present for comparison with archaeological specimens. Thus preservation conditions, ease of identification, and access to comparative material have introduced bias into the analysis of the fish material.

The infrequent bird and reptile unidentified material was simply counted and weighed. Bone weights, counts, and MNIs were all used in this analysis as frequency measures.